Expressions and Equations Webinar

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Presenters

Michele Carney

- Associate Director – MTI
- michelecarney@boisestate.edu

Dr. Gwyneth Hughes

- Regional Mathematics Specialist
- gwynethhughes@boisestate.edu

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Technical Items

If you have speakers connected to your computer you should be able to hear audio through that mechanism.

If you cannot hear right now the number is:

- Toll-free: 1 877 568 4108
- Access Code: 682-804-359
- Audio PIN: 40

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Overview

- Examine *Expressions & Equations* and *Functions* domain topics in:
  - Current Idaho State Standards
  - Common Core Standards
- Focus on investigating multiple representations as a means of building student understanding
- Links to MTI course

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Standards Names/Definitions

- The standards that have been in place for the past several years and are currently being assessed on ISAT will be referred to as the ***current Idaho State Standards***.
- The new standards (adopted in spring 2011 for implementation in fall 2013) will be referred to as the ***Common Core State Standards***

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Timeline for implementation of the Common Core State Standards & Smarter Balance Assessment

- Current Kindergarteners will never be tested on the existing Idaho state standards
- Current 7th graders will be required to pass a test of the new standards
- Can we wait to begin implementation?

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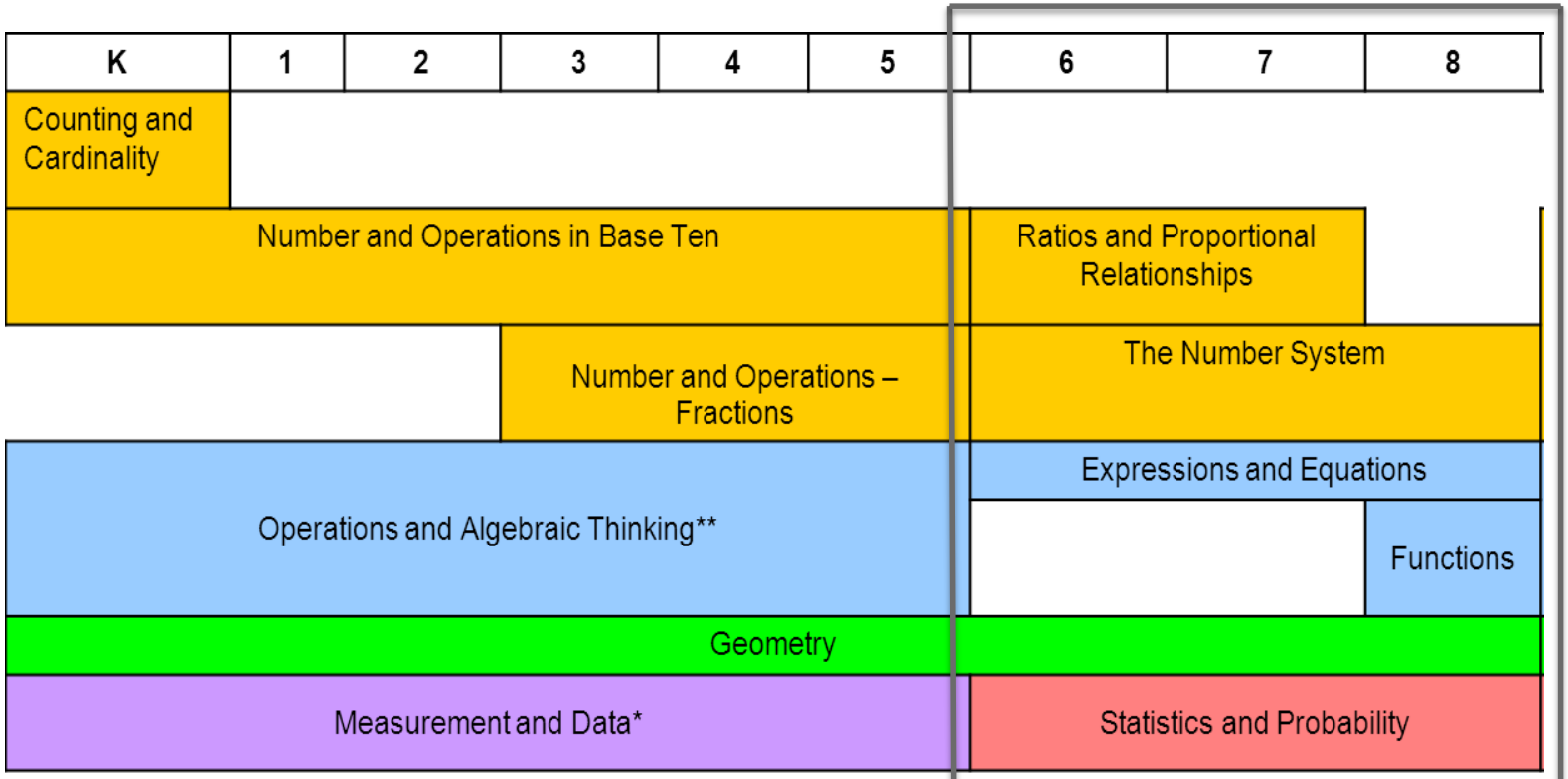
Domain Progressions in the CCSS



* K-5 Measurement and Data splits into Statistics and Probability and Geometry in Grade 6

**Operations and Algebraic Thinking is foundation for Grade 6 Expressions and Equations and The Number System

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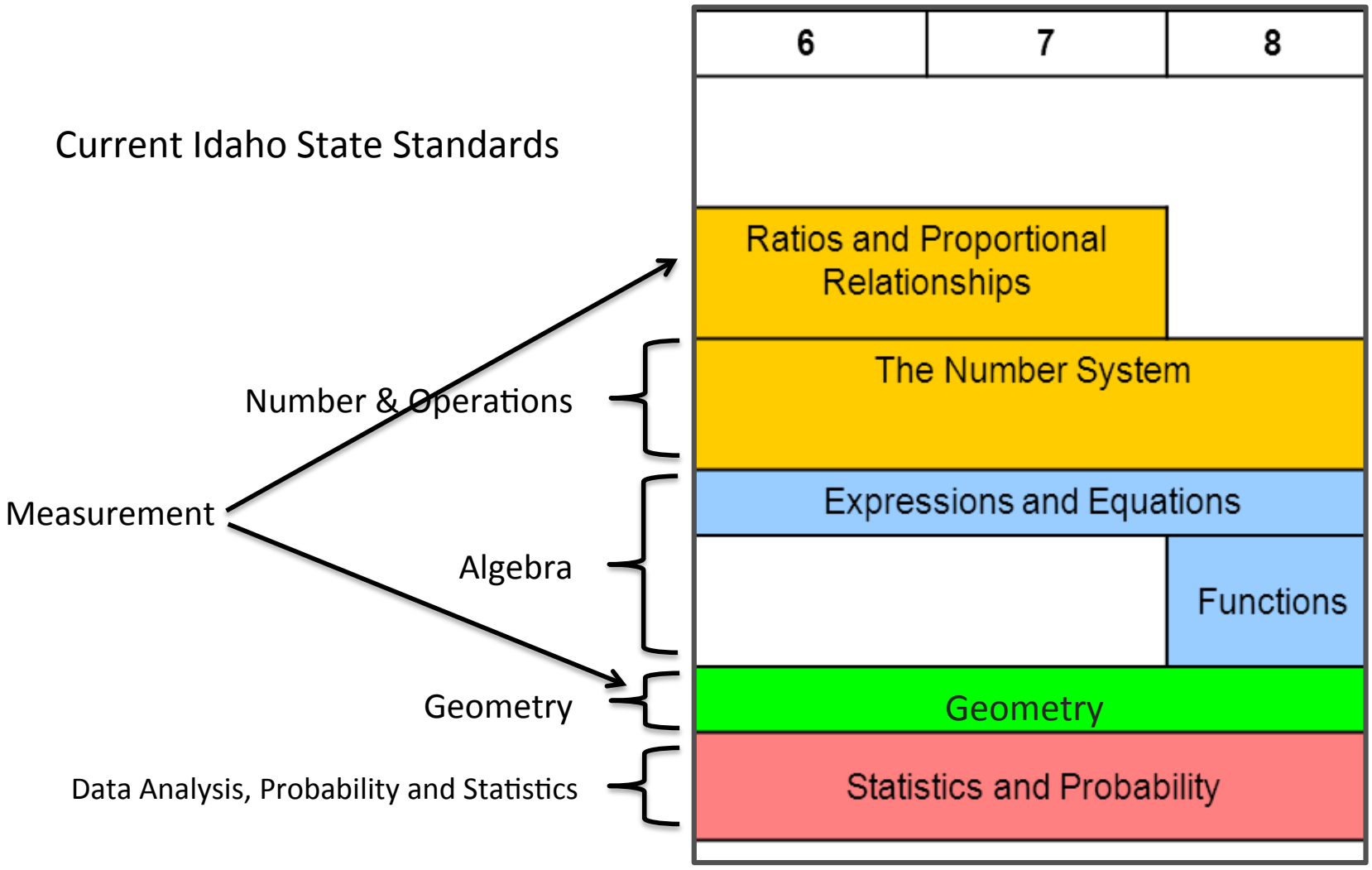

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Goal 3.1: Use algebraic symbolism as a tool to represent mathematical relationships.

6.M.3.1.1 Discuss the meaning and use of variables in simple expressions and equations.

6.M.3.1.2 Translate simple word statements into algebraic equations.

6.M.3.1.3 Read and use symbols of "<," ">," and "=" to express relationships.

Goal 3.2: Evaluate algebraic expressions.

6.M.3.2.1 Use the following properties in evaluating numerical expressions: commutative, associative, identity, zero, inverse, and distributive.

6.M.3.2.2 Evaluate simple algebraic expressions using substitution.

Goal 3.3: Solve algebraic equations and inequalities.

6.M.3.3.1 Solve one-step equations with whole numbers.

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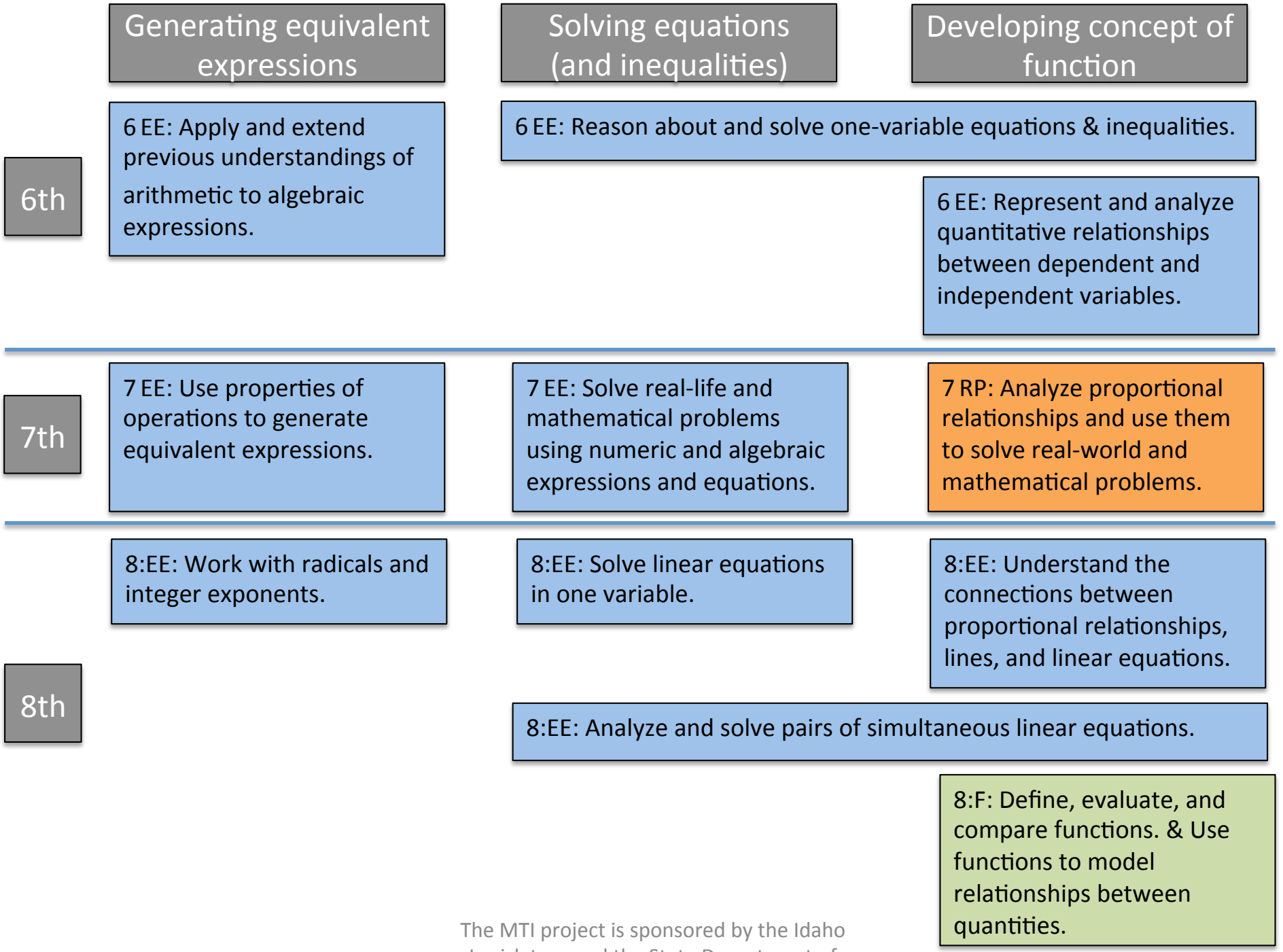

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Two conceptions of variable:

Solving equations

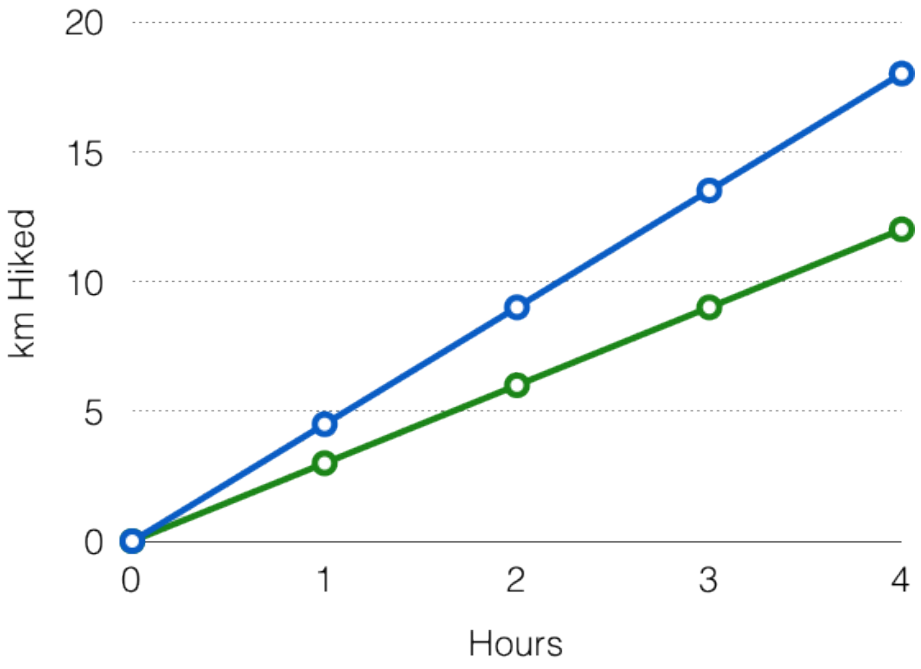
Developing concept of function

Variable as unknown

Two identical silver bars plus 2 ounces weigh 7 ounces all together. How much does one silver bar weigh?

$$2x + 2 = 7$$
$$-2 \quad -2$$
$$\frac{2x}{2} = \frac{5}{2}$$

Variable as varying quantity



d = 5t
d = 3.5t

d = km Hiked
t = Hours Hiked

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Variable as an Unknown

MULTIPLE REPRESENTATIONS AND STRATEGIES

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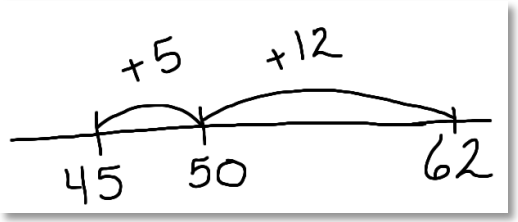
Context

Nichole has 45 marbles. Tim gives her 17 more. How many does she have all together?

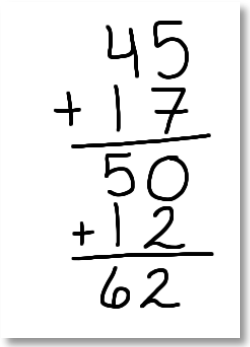
Computational Flexibility



Bare Problems

45 + 17 = ?

Multiple Strategies & Representations



Enactive → Iconic → Symbolic

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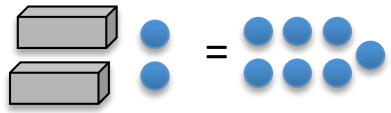
Context

Two identical silver bars plus 2 oz weigh 7 oz all together. How much does one silver bar weigh?

Algebraic Flexibility



Bare Problems

2b + 2 = 7

Multiple Strategies & Representations

Enactive → Iconic → Symbolic

$$\frac{2x+2}{2}=\frac{7}{2}$$

$$x+1=3.5$$

$$x=2.5$$

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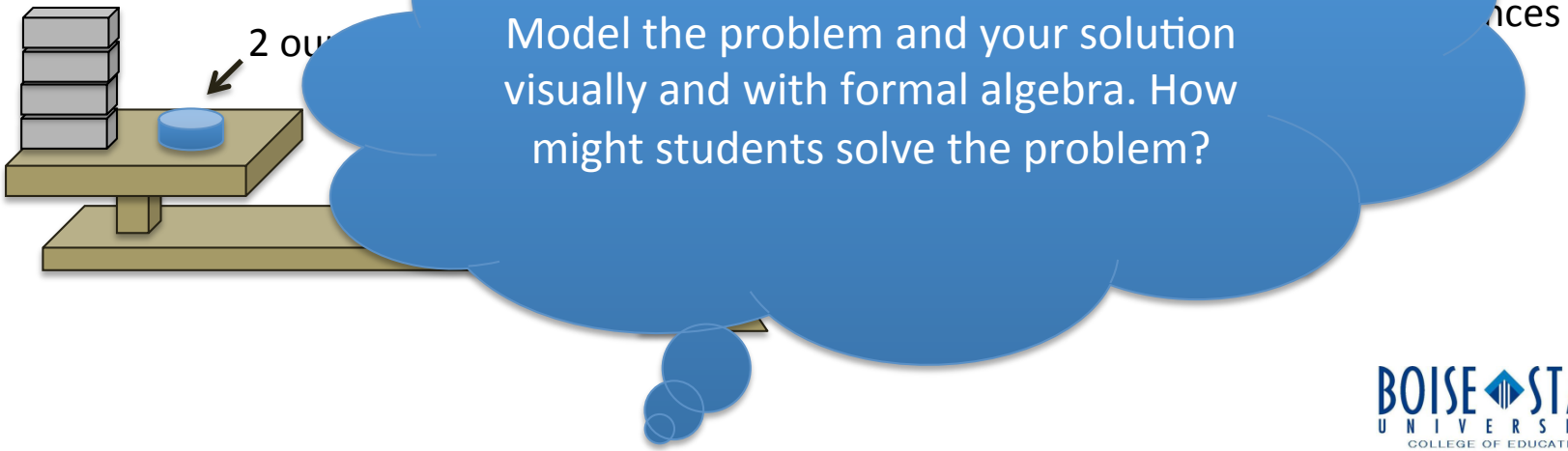
Context

Sarah has 6 identical silver bars and is trying to figure out how much just one weighs.

She knows 4 bars plus 2 ounces weighs the same as 2 bars plus a 10 ounce weight.

Help her figure out the weight of one bar.



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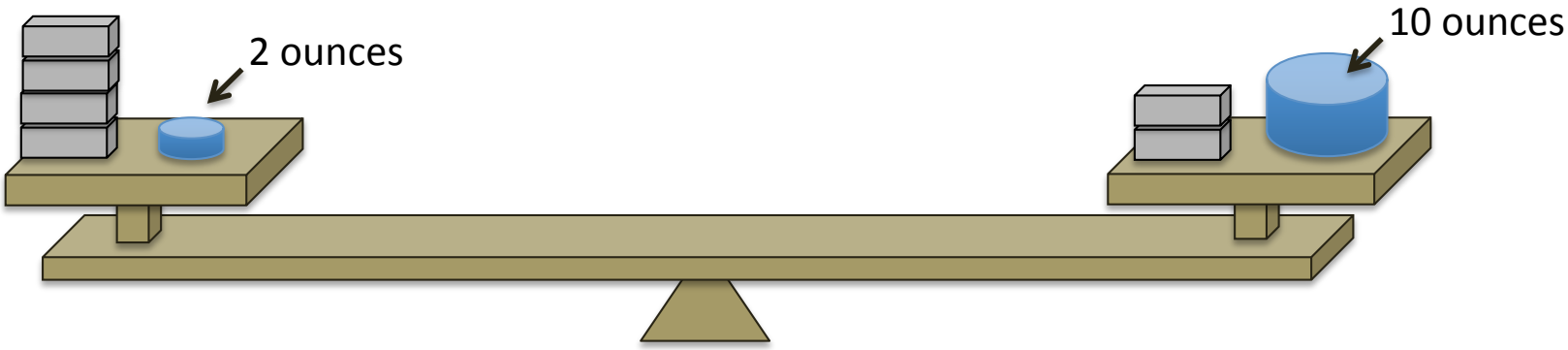
Informal Strategy: Guess and Check



If the bar weighs one ounce…

$4(1)+2 \stackrel{?}{=} 2(1)+10$

$6 \neq 12$

If the bar weighs two ounces…

$4(2)+2 \stackrel{?}{=} 2(2)+10$

$10 \neq 14$

And so on…

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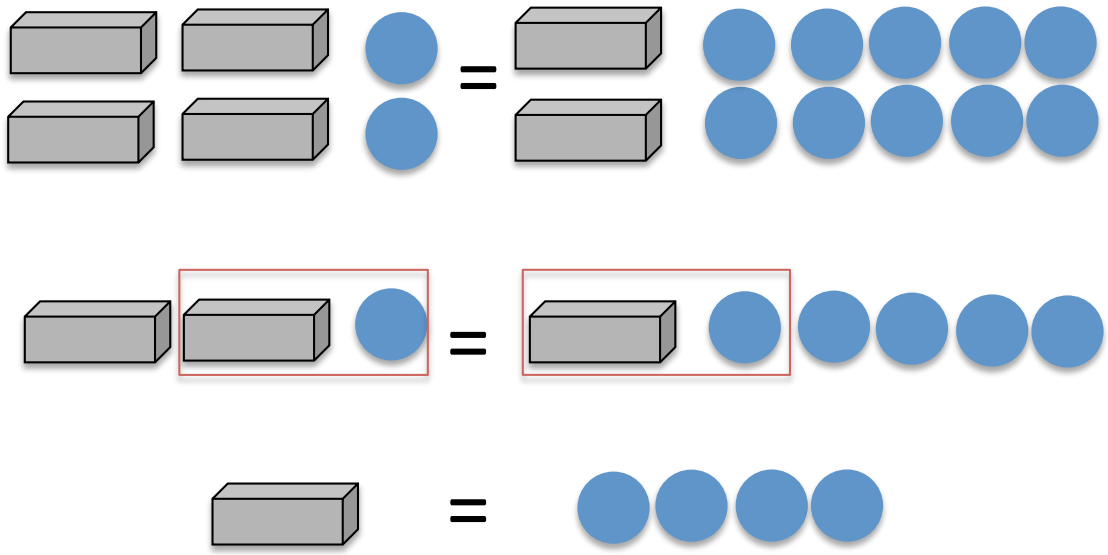
Model: Enactive -> Iconic

Represents 1 ounce

Represents 1 silver bar

How many ounces is 1 silver bar?



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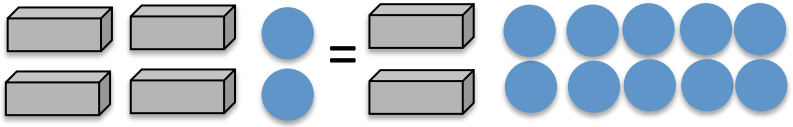
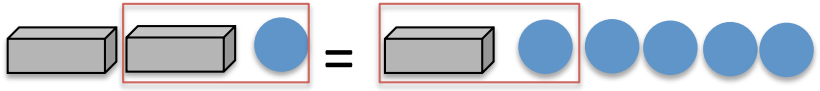
Model: Iconic -> Symbolic



$$\frac{4b+2}{2} = \frac{2b+10}{2}$$



$$2b+1 = b+5$$

$$b+b+1 = b+1+4$$

$$b = 4$$

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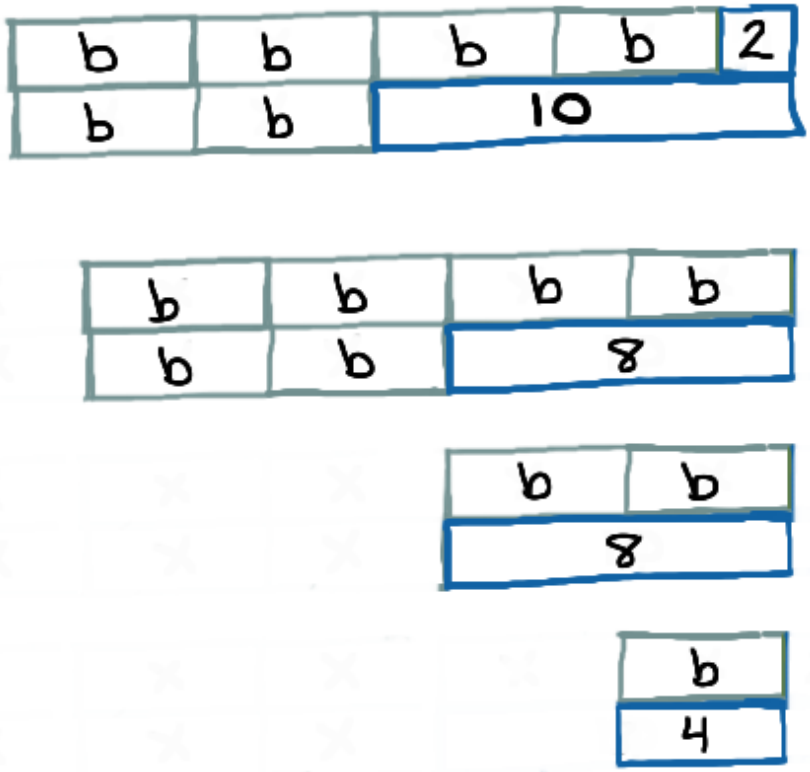
Model: Iconic -> Symbolic



$4b + 2 = 2b + 10$

$-2 \quad -2$

$4b = 2b + 8$

$2b \quad -2b$

$\frac{2b}{2} = \frac{8}{2}$

$b = 4$

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Context

Two identical silver bars plus 2 oz. weigh 7 oz. all together. How much does one silver bar weigh?

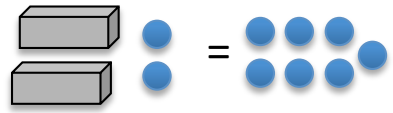
Algebraic Flexibility

Bare Problems

$2b + 2 = 7$

Multiple Strategies & Representations

Enactive → Iconic → Symbolic



$$\frac{2x+2}{2} = \frac{7}{2}$$

$$x + 1 = 3.5$$

$$x = 2.5$$

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Flexibility

$\frac{1}{2}(5 + 3x) = 15$

Algorithmic Solution

$$\frac{1}{2}(5)+\frac{1}{2}(3x)=15$$

$$2.5+1.5x=15$$
$$-2.5 \qquad -2.5$$
$$1.5x=12.5$$
$$\frac{1.5x}{1.5}=\frac{12.5}{1.5}$$
$$x=8.\overline{3}$$

Flexible Solution

$$5+3x=30$$
$$-5 \qquad -5$$
$$3x=25$$
$$\frac{3x}{3}=\frac{25}{3}$$
$$x=8.\overline{3}$$

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Understanding Equality

$34 + 21 = \square + 23$

Operational versus relational understanding of the equal sign.

"A sign connecting the answer to the problem."

"The total."

"How much the numbers added together equals."

"What the problem's answer is."

(From Knuth 2006)

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Understanding Equality

$$34 + 21 = \square + 23$$

Operational versus relational understanding of the equal sign.

"The left side of the equals sign and the right side of the equals sign are the same value."

"The same as, the same value"

"The expression on the left side is equal to the expression on the right side."

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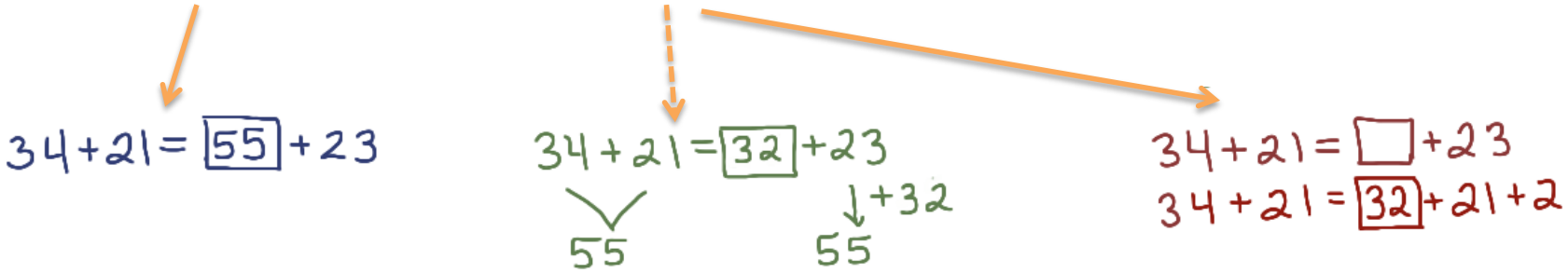

$$3x + 2 = 29$$

3(?) + 2 = 29

$$4x + 2 = 2x + 10$$

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Variable as a Varying Quantity

MULTIPLE REPRESENTATIONS

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Context: Jane has $18 and decides to save $2 per week.

- How much money does she have after 2 weeks? 10? 15?
- How long will it take her to get to $63?

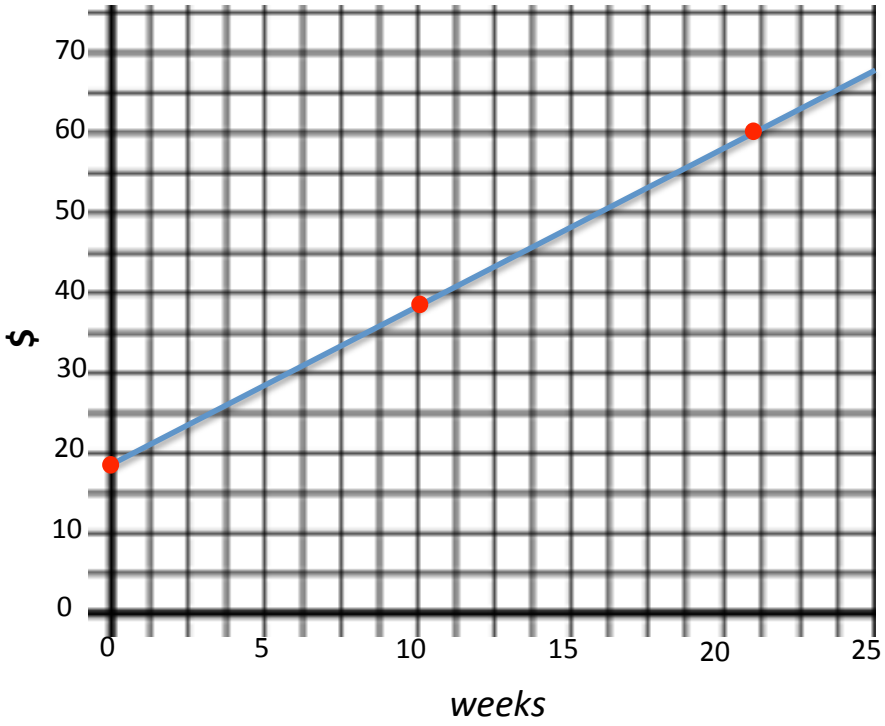
Table: Create a table to solve the problem or display your answers.

$	18	20	22	26	30	34	38	58	48	60	62	64
wks	0	1	2	4	6	8	10	20	15	21	22	23

Equation: ??

What questions could we ask to press students to write an equation?

Graph: Create a graph to solve the problem or display your answers.



Context: Jane has $18 and decides to save $2 per week.

- How much money does she have after 2 weeks? 10? 15?
- How long will it take her to get to $63?

Table: Create a table to solve the problem or display your answers.

$	18	20	22	26	30	34	38	58	48	60	62	64
wks	0	1	2	4	6	8	10	20	15	21	22	23

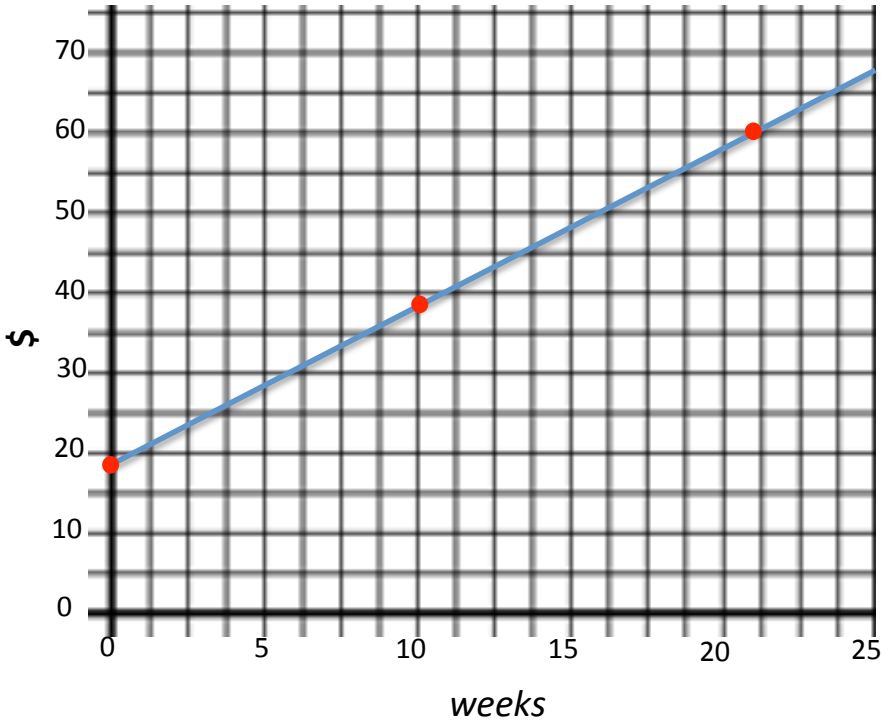
Equation: Write equations that would help answer the following questions:
- How much money does she have if you know how many weeks have passed?
- How many weeks have passed if you know how much money is in her account?

$\$ = 18 + 2 \cdot wks$

$wks = \frac{\$ - 18}{2}$

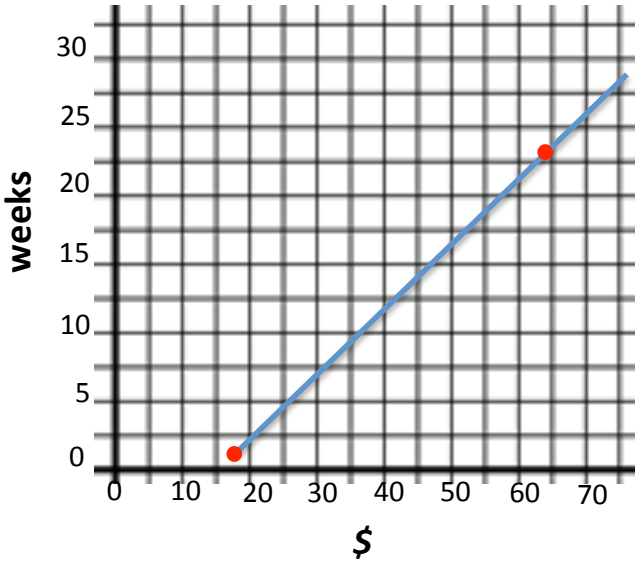
$y = 2x + 18$

Graph: Create a graph to solve the problem or display your answers.



Are all the representations correct? What connections can you see between them?

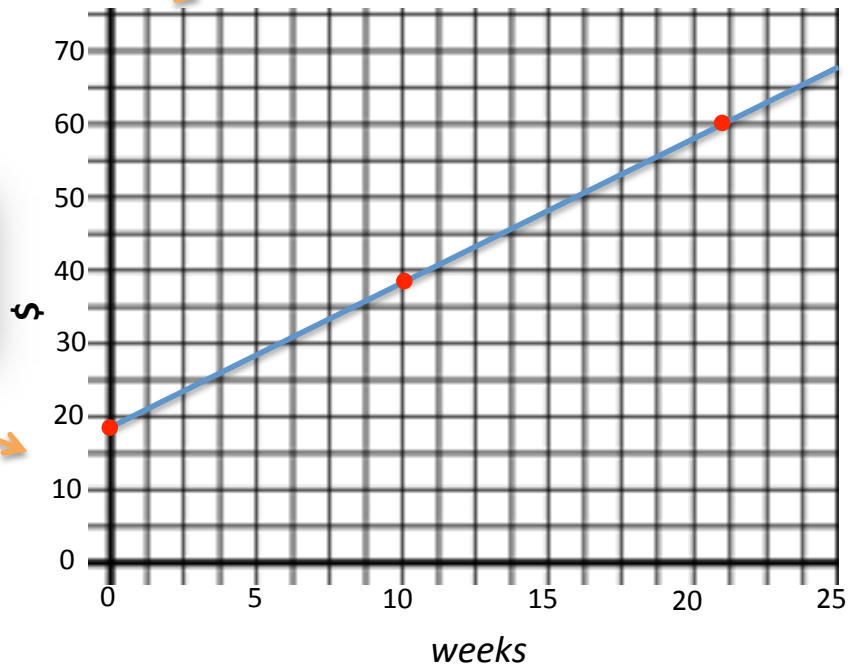
$	18	20	22	26	30	34	38	58	48	60	62	64
wks	0	1	2	4	6	8	10	20	15	21	22	23



$$\$ = 18 + 2 \cdot wks$$

$$wks = \frac{\$ - 18}{2}$$

$$y = 2x + 18$$

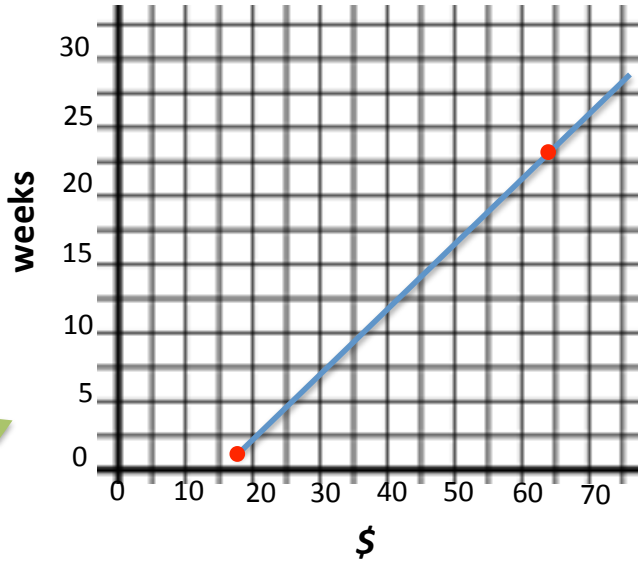


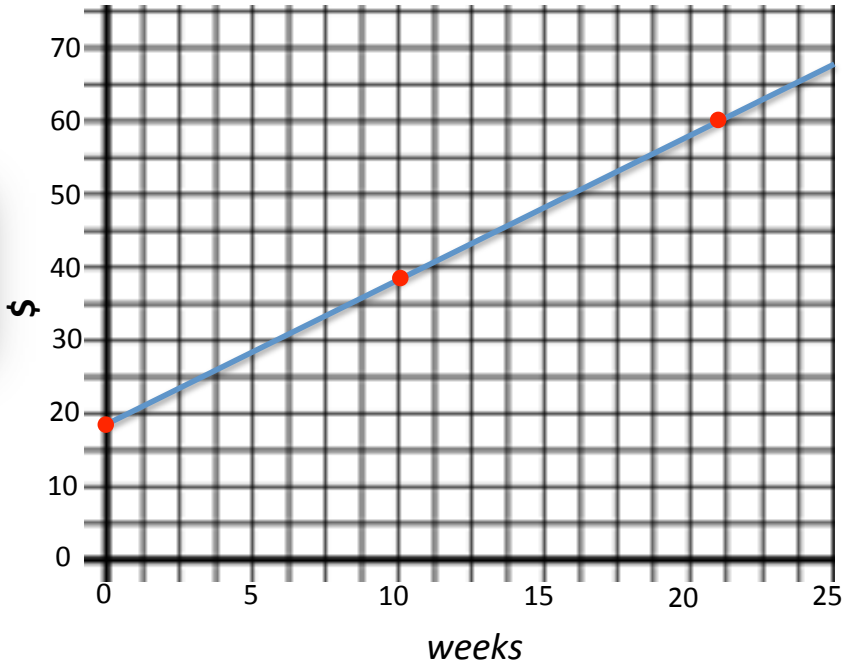
$	18	20	22	26	30	34	38	58	48	60	62	64
wks	0	1	2	4	6	8	10	20	15	21	22	23

$$\$ = 18 + 2 \cdot wks$$

$$wks = \frac{\$ - 18}{2}$$

$$y = 2x + 18$$



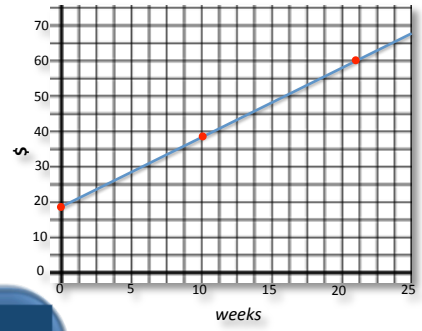


Relationship Perspectives

Context

Jane has $18 and decides to save $2 per week.

Multiple Representations



$\$ = 18 + 2 \cdot wks$

$	18	20	22	26	30
wks	0	1	2	4	6

Bare Problems

$y = 18 + 2x$

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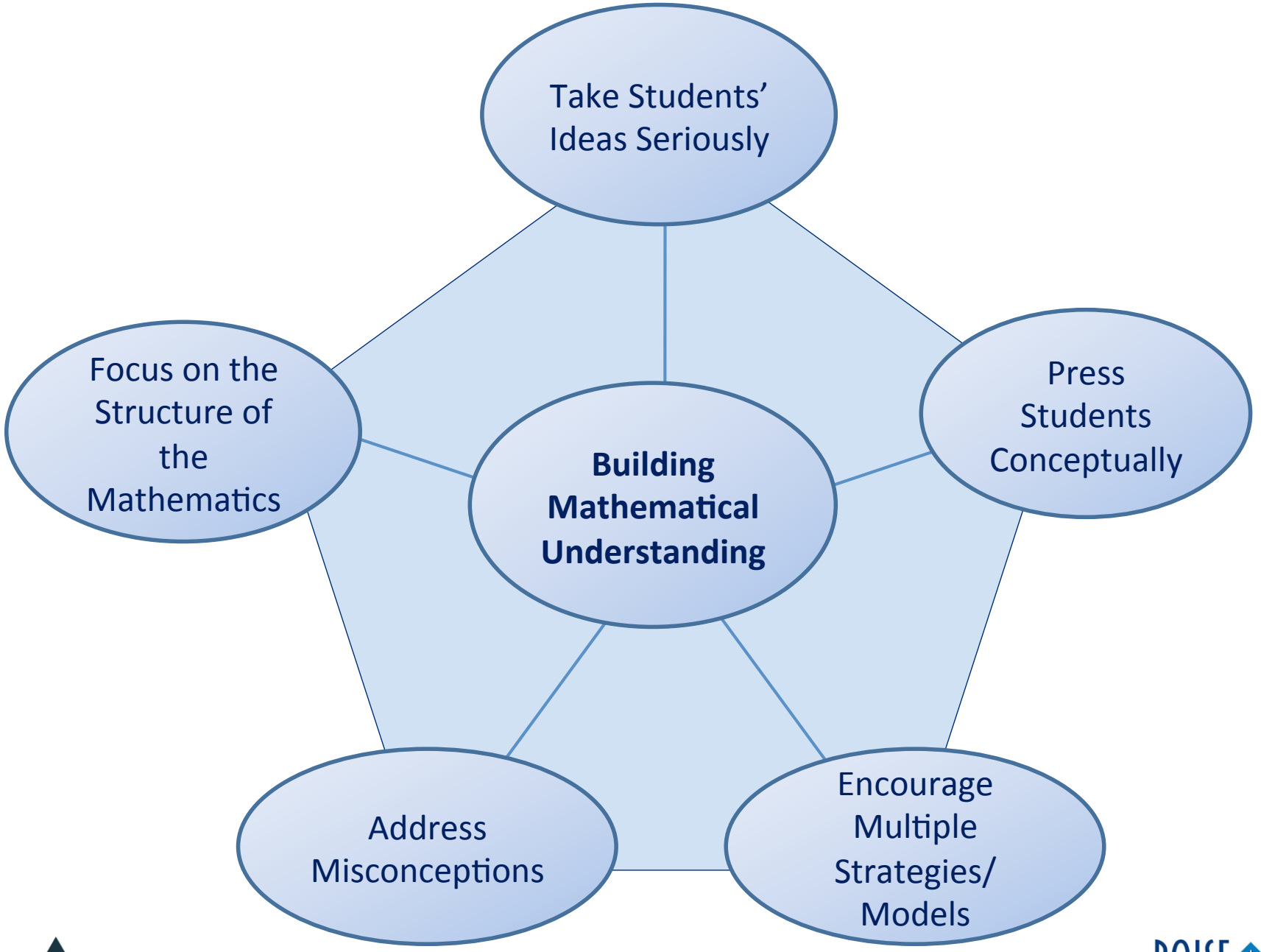

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1 Credit Opportunity

- Duration: Accumulate 15 hours of webinar training, live or archived. Additional webinars will be developed and offered during the Fall of 2012. The credit will be earned the semester the 15 hours is completed.

- Registration: Upon completion of the 15 hours, a participant will register with BSU for the one professional education credit.

- Documentation: Completion of a brief webinar summary and reflection for each webinar is required.
- Cost: $65
- Note: The one professional education credit earned for completion and payment of $65, does not count towards the three credits earned with completion of the MTI course. The webinars are follow-up support after completion of the MTI course.
- Information: http://www.sde.idaho.gov/site/math/mti.htm
- Questions: Nichole Hall nhall@sde.idaho.gov

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Thank you for attending the webinar!

- Questions

- Contact Information
  - Michele Carney michelecarney@boisestate.edu
  - Gwyneth Hughes gwynethhughes@boisestate.edu

- DMT Website- http://dmt.boisestate.edu

- Follow Up Opportunities: http://www.tinyurl.com/mtifollowup

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